

FISH DIVERSITY, PRODUCTION POTENTIAL AND COMMERCIAL FISHERIES OF RAMSAGAR RESERVOIR, DATIA, MADHYA PRADESH, INDIA

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This contribution focuses on the fish diversity, production dynamics and commercial fisheries of Ramsagar reservoir. Ramsagar is a small (140 ha) man-made reservoir in Datia district, Madhya Pradesh, India, constructed over Nichroli nallah in the Sindh river basin. A total of 42 species of fishes belonging to 28 genera, 15 families and 6 orders were recorded. Order Cypriniformes with 21 species showed maximum species diversity; minimum species diversity was shown by orders Beloniformes, Osteoglossiformes and Synbranchiformes with one species each. Out of 42 species, 15 species were identified as commercially important. According to their economic importance these fishes are categorized into three groups. They are major carps (*Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*), local major (*Wallago attu*, *Heteropneustes fossilis*), and local minor (*Puntius conchonius*, *P. sarana*, *P. sophore*, *P. ticto*, *Xenentodon cancila*, *Notopterus notopterus*, *Mastacembelus armatus*, *Channa marulius*, *C. striata* and *C. punctatus*). The fish production data of the last five years of the reservoir revealed that maximum fish yield (45.62 kg/ha/yr) was recorded in 2000-01, which is lower than the average fish yield of Indian reservoirs. Fish yield rate upto 100, 75, 50 kg/ha/year in respect of small, medium and large Indian reservoirs.

Keywords: Fish diversity, commercially important fishes, fish yield, Ramsagar reservoir

INTRODUCTION

India is one of the mega biodiversity hotspots contributing to the world's biological resources. Central India, including the three states: Madhya Pradesh, Chattisgarh and Rajasthan, has diverse water resources such as streams, rivers, reservoirs, sub-terrain aquatic systems, traditional lakes and domestic ponds that harbour a wide variety of freshwater fishes (Sarkar and Lakra 2007). Fisheries resources occupy a prominent place in the economy of any country. The main benefits that can be derived from fishery development and its associated growth can be categorized as (a) nutritional and food supply (b) income (c) employment (d) infrastructure and (e) rescue and defence services.

Out of the total fish production of c. 5.66 million tonnes during 1999-2000, about 3.84 million tonnes came from marine sources and the rest are from inland waters. The Inland fish diversity of India is vast and varied, and one of the richest in the world (Tamang *et al.* 2007). Inland aquaculture contributes to 70% of total global fish production (Simoes *et al.* 2008). It includes the great river systems and extensive network of irrigation canals, man-made reservoirs, lakes, ponds, tanks, etc. The capture, culture and culture-cum capture fisheries have different settings and require different inputs, infrastructure and developmental strategy (Verma 1969).

Development of inland fisheries mainly depends on the intensity of stocking cultivable waters with quick growing

fishes, namely major carps and exotic varieties. This in turn depends on the production of large quantities of cultivable fish seed, including fish fry and fingerlings in state fish farms and nurseries. In the context of a chronically protein deficient diet of majority of the people in India, especially in Madhya Pradesh, the production of protein food, like fish need special attention. Therefore, fisheries and its development should form an important aspect of planning, so as to provide cheap protein food. Besides providing direct employment, the industry is also an important income generator as it supports canneries, processing establishments, gear and equipment manufacturers, boat yards, refrigeration and ice-making plants, and transport services in addition to those working in State Fisheries Department, Fisheries Corporation, and other government fisheries based institutions. In view of the above, a study of fish diversity, production potential and yield of fish has been undertaken in the present communication.

MATERIAL AND METHODS

Study site: Ramsagar is a small man-made reservoir with a spread of c. 140 ha constructed on Nichroli nallah, a tributary of Sindh river. The reservoir is located c. 80 km south of Gwalior and 8 km north-west of Datia city, Madhya Pradesh (Fig. 1). Geographically, it lies between 25° 40.48' N and 78° 23.88' E at an altitude of 229 m above msl. The Reservoir is used for different purposes, like drinking water supply,

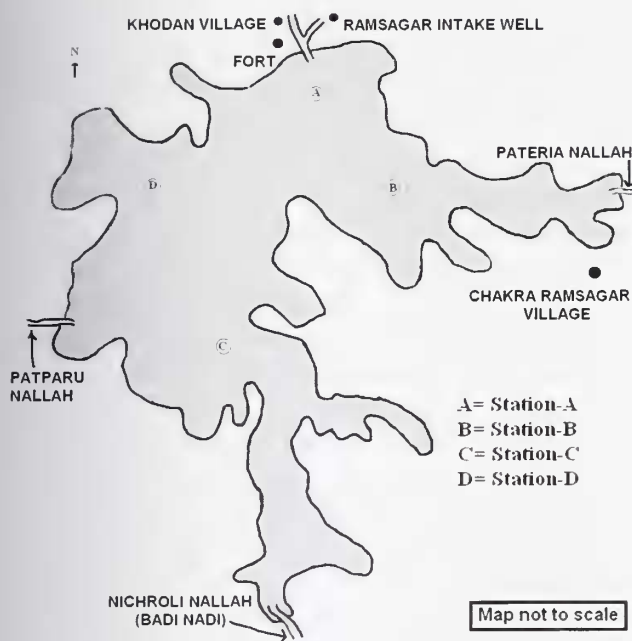


Fig. 1: Text figure of Ramsagar reservoir showing sampling stations

irrigation, fisheries, etc. It is totally rain fed through various drains that bring water from the surrounding hilly catchment areas, except the side having 'pucka (concrete)' and 'Kachcha (earthen)' embankments.

Methods: The fish specimens were collected twice every season using dragnets, gill nets and cast net (Ghagara Jaal) with the help of local fishermen. Smaller specimens were preserved in 8% formalin, while large specimens were dissected for visceral preservation and later preserved in

formalin. The specimens were identified to species level using keys provided by Srivastava (1980), Talwar and Jhingran (1991) and Jayaram (1999).

Fishing activity in the reservoir is directly under the control of Assistant Director, M.P. Government Fisheries Department, Datia, whose office is located near Lala Ka Tal in Datia city. The data on fish production of the reservoir were collected from this office.

RESULTS AND DISCUSSION

The ichthyofauna of a reservoir represents the faunal diversity of the parent river system. Studies conducted so far indicate that large reservoirs harbour around 60 species of fishes, of which at least 40 contribute to commercial fisheries. The fast growing Indo-Gangetic carps, popularly known as Indian major carps, occupy a prominent place among commercially important fishes. More recently, a number of exotic species have also contributed substantially to commercial fisheries. A database on fisheries resources of the reservoir ecosystem seems to be an essential prerequisite for a meaningful management of the aquatic resources.

Fish Diversity: The fish species obtained during the survey under the present study were found to belong to 42 species under 28 genera, 15 families and 6 orders (see Appendix 1). The maximum numbers of fish species (21) belong to Family Cyprinidae (50%). Families Notopteridae, Balitoridae, Sisoridae, Clariidae, Heteropneustidae, Belonidae, Mastacembelidae, Chandidae, Nandidae, and Gobiidae are represented by only one species (2.38%); families Siluridae and Schilbeidae are represented by two species (4.76%), Family Channidae is represented by three species (7.14%), and Family Bagridae is represented by four species (9.52%) (Table 1). Order-wise, maximum fish species (52.38%) is represented by Cypriniformes (Fig. 2). Dubey and Verma (1965), while studying the fish fauna of Madhya Pradesh, reported 104 species, of which 50% belong to Family Cyprinidae. Bhat (2003) studied the diversity and composition of freshwater fishes in river systems of Western Ghats and recorded 92 species, with Cyprinidae being the dominant group. Agarwal and Saksena (1977) studied the fish fauna of Madhya Pradesh and reported 48 species, of which 39.58% belong to Family Cyprinidae. Dubey *et al.* (1980) recorded 70 fish species, including exotic species from Chambal division, of which Family Cyprinidae contributed 45.71%. Rao *et al.* (1988) studied Gandhisagar reservoir and reported 41 species, of which Family Cyprinidae contributed 53.65%. Saxena and Shrivastava (1989) studied fishes of Kunwari river, north Madhya Pradesh, and recorded 46 species with 47.82% of

Table 1: Fish species richness in Ramsagar Reservoir

S. No.	Families	Genera	Species	% Contribution of families
1.	Cyprinidae	11	21	50.00
2.	Bagridae	02	04	9.52
3.	Channidae	01	03	7.14
4.	Siluridae	02	02	4.76
5.	Schilbeidae	02	02	4.76
6.	Sisoridae	01	01	2.38
7.	Clariidae	01	01	2.38
8.	Heteropneustidae	01	01	2.38
9.	Belonidae	01	01	2.38
10.	Mastacembelidae	01	01	2.38
11.	Chandidae	01	01	2.38
12.	Nandidae	01	01	2.38
13.	Gobiidae	01	01	2.38
14.	Balitoridae	01	01	2.38
15.	Notopteridae	01	01	2.38
Total		28	42	

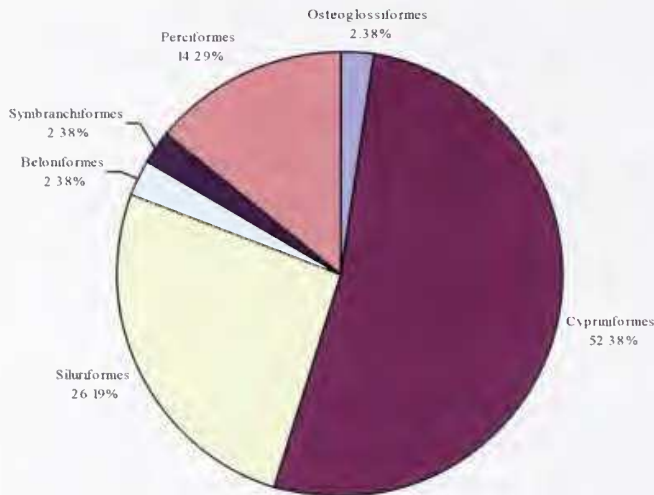


Fig. 2: Percentage contribution of different orders of fish species in the Ramsagar reservoir

Family Cyprinidae. If a comparison of fish fauna of Ramsagar reservoir is made with other reservoirs and water bodies, it becomes quite apparent that, the Ramsagar reservoir has rich fish diversity with maximum contribution of Family Cyprinidae. Saksena and Verma (1993) have reported 3 species of genus *Tor* and 7 species of genus *Puntius* from Madhya Pradesh. In the present study, only *Tor tor* has been reported. Shukla *et al.* (2003) have described 39 species of fishes with family Cyprinidae contributing more than 51%. Sarkar *et al.* (2007) studied Samaspur Bird Sanctuary, Uttar Pradesh, and recorded 46 fish species belonging to 7 orders, 19 families and 33 genera. Saksena (2007) has revised the list of fishes from north Madhya Pradesh and reported a total of 73 species, including 7 species of exotic fishes.

Fish Production Potential: In the developed world, fisheries of inland lakes and reservoirs largely cater to recreational needs, whereas in a highly populous developing country like India, these resources can play a vital role in augmenting food production for human consumption and mitigating protein deficiency. The national fish production rate of Indian reservoirs is estimated as 20.13 kg/ha/yr (Sugunan 1997; Ahirrao and Mane 2000) with a modest increase in fish yield rate up to 100, 75, and 50 kg/ha/yr with

respect to small, medium and large Indian reservoirs (Sugunan 1997). The present low level of fish production in Indian reservoirs can be attributed to inadequate management as many of them have high propensities of production from a limno-chemical point of view (Khedkar 2005). In many of the reservoirs, the high rate of primary and secondary productivity is not being channelized to fish production (Khanna and Bhutiani 2005). Insufficient understanding of the reservoir ecosystem often comes in the way for adopting effective management measures (Paik and Chakraborty 2003). The productivity from the reservoirs can be increased through a number of approaches like better management measures, higher value for fish catch through improvement in processing and marketing and through more equitable distribution of benefits (Sultan *et al.* 2005). Fish yield of 74.80 kg/ha/yr has been recorded in Markonahalli reservoir, Karnataka (Ramakrishnaiah *et al.* 1998) whereas, Jhingran and Sugunan (1990) have recorded fish productivity as 100 kg/ha/yr in Gulariya reservoir. Khan *et al.* (1990) observed fish productivity of 139.60 kg/ha/yr in Bachhara reservoir. Murugesan and Manoharan (2000) recorded fish productivity of 224.80 kg/ha/yr in privately managed Palar-Poranthian reservoir. A fish productivity of 133.50 kg/ha/yr was found in Naktara reservoir, Madhya Pradesh (Dwivedi *et al.* 2000). The fish productivity in Ramsagar reservoir was recorded for five years and it is observed that maximum fish productivity (45.62 kg/ha/yr) occurred in 2000-2001, while minimum fish productivity (8.96 kg/ha/yr) was seen in 2002-2003. If we compare fish productivity of Ramsagar reservoir with other reservoirs, we notice that, productivity of Ramsagar reservoir is very low. This could be primarily due to escape of fishes from sluice gates at the time of discharge of water for irrigation and drinking supply to Datia city, disturbing the balance of fish production in the reservoir. Diminished natural breeding ultimately reduces the fish production in Ramsagar reservoir. The Reservoir is primarily meant for irrigation, flood control and drinking purposes. Fisheries have been recognized as a secondary activity. Hence, fish production management practices are constrained and have limited scope for adoption of modern practices. The inflow

Table 2: Royalty charges of Fisheries Department and fish price in Datia and Gwalior market

S. No.	Species	Fisheries Department charges (royalty) /kg	Market rates of Fish/kg
1.	Major Carps: <i>Catla catla</i> , <i>Labeo rohita</i> , <i>Cirrhinus mrigala</i>	14.00 Rs/kg	60-65 Rs/kg
2.	Local Major: <i>Wallago attu</i> , <i>Heteropneustes fossilis</i>	10.00 Rs/kg	50-60 Rs/kg
3.	Local Minor: <i>Puntius conchonius</i> , <i>P. sarana</i> , <i>P. sophore</i> , <i>P. ticto</i> , <i>Xenentodon cancula</i> , <i>Notopterus notopterus</i> , <i>Mastacembalus armatus</i> , <i>Channa marulius</i> , <i>C. striata</i> , <i>C. punctatus</i>	8.00 Rs/kg	20-25 Rs/Kg

Table 3: Year-wise fish production of Ramsagar Reservoir

S. No.	Year	Seed of fish species	Total fish seed released in the reservoir	Fish yield/ ha	Total fishing yield from the reservoir	Royalty collected from fishermen by Fisheries Department
1.	2000-01	(a) <i>Catla catla</i> (b) <i>Labeo rohita</i> (c) <i>Cirrhinus mrigala</i>	2, 80, 000.00*	45.62 kg/ha/yr	6.3925 metric tons (6, 392.50 kg)	Rs. 69, 293.00
2.	2001-02	(a) <i>Catla catla</i> (b) <i>Labeo rohita</i> (c) <i>Cirrhinus mrigala</i>	2, 35, 000.00*	23.64 kg/ha/yr	3.313 metric tons (3, 313.00 kg)	Rs. 35, 556.00
3.	2002-03	(a) <i>Catla catla</i> (b) <i>Labeo rohita</i> (c) <i>Cirrhinus mrigala</i>	2, 35, 000.00*	8.96 kg/ha/yr	1.256 metric tons (1, 256.00 kg)	Rs. 11, 210.00
4.	2003-04	(a) <i>Catla catla</i> (b) <i>Labeo rohita</i> (c) <i>Cirrhinus mrigala</i>	1, 55, 000.00*	23.97 kg/ha/yr	3.359 metric tons (3, 359.00 kg.)	Rs. 30, 634.00
5.	2004-05	(a) <i>Catla catla</i> (b) <i>Labeo rohita</i> (c) <i>Cirrhinus mrigala</i>	2, 80, 000.00*	27.10 kg/ha/yr	3.798 metric tones (3, 798.00 kg)	Rs. 37, 504.00

*Fish seed (fingerlings) 100-105 mm in size

and outflow of water and highly fluctuating water levels are main reasons for low fish productivity of Ramsagar reservoir affecting the same adversely.

Commercial Fisheries of Ramsagar Reservoir: Out of 42 fish species, 15 species were identified as commercially important fetching good market price. According to their economic importance these fishes are categorized into three groups (Table 2): major carps (*Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*), local major (*Wallago attu*, *Heteropneustes fossilis*), local minor (*Puntius conchonius*, *P. sarana*, *P. sophore*, *P. ticto*, *Xenentodon cancila*, *Notopterus notopterus*, *Mastacembelus armatus*, *Channa marulius*, *C. striata*, and *C. punctatus*). The fish caught from the reservoir are marketed locally in Datia fish market and are seldom transported to other places. The fish marketing surveys conducted in Datia and Gwalior city revealed that there was one wholesale fish market each in Datia and Gwalior, and five retail markets in Datia and Badoni town and six in Gwalior city. All fishes sold are fresh. There was no major fish drying process at the reservoir, however, a small quantity of dried fish are dispatched to Gorakhpur. The data collected for the last five years on fisheries resources of Ramsagar reservoir show that maximum fish were caught from February to April and these were procured by the Fishermen Co-operative Societies. The payments to the society are made on weekly basis. The Co-operative Societies

dispatch the fishes by Jeep from Ramsagar reservoir to wholesale markets at Datia and Ladheri in Gwalior city. The fishes are sold at the rate of Rs. 50-70/kg during different months in different markets. It is alarming that there is much lower fish production rate in Ramsagar as compared to other Indian reservoirs (Sugunan 1997; Khedkar 2005). Kharat *et al.* (2003) have suggested various strategies for conservation of fish including halting of siltation, promoting controlled harvest, imposing checks on exotic species, introduction of carp fingerlings, controlling water pollution and construction of fish ladders on dams.

It has been observed that illegal fishing practices also reduce the annual yield of fish. The vast area of the Ramsagar reservoir invites poachers for illegal fishing. The reservoir should be suitably protected against unauthorized and illegal fishing to safe guard the stock. Because of non-availability of patrolling crafts, the security staff is quite handicapped in performing their duties. It was proposed to strengthen the staff and also to provide them with mechanized boats for patrolling the reservoir, so that the fishing wealth of the Ramsagar reservoir is suitably protected, especially during the breeding season. The Fisheries Department of the Government of Madhya Pradesh has started implementing some measures for stock replenishment of major carps by introducing fingerlings, for the last few years (Table 3). This would yield good results in years to come.

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Appendix 1: Systematic list of fish species recorded in the Ramsagar Reservoir

- Order:** Osteoglossiformes
Family: Notopteridae
Genus: *Notopterus* Lacépède
 1. *Notopterus notopterus* (Pallas)
- Order:** Cypriniformes
Family: Cyprinidae
Subfamily: Danioninae
Genus: *Salmostoma* Swainson
 2. *Salmostoma bacaila* (Hamilton-Buchanan)
 3. *Salmostoma clupeoides* (Bloch)
- Genus:** *Barilius* Hamilton-Buchanan
 4. *Barilius barila* (Hamilton-Buchanan)
 5. *Barilius bendelisis* (Hamilton-Buchanan)
 6. *Barilius bola* (Hamilton-Buchanan)
- Genus:** *Rasbora* Bleeker
 7. *Rasbora daniconius* (Hamilton-Buchanan)
- Genus:** *Danio* Hamilton-Buchanan
 8. *Danio devario* (Hamilton-Buchanan)
- Subfamily:** Cyprininae
Genus: *Tor* Gray
 9. *Tor tor* (Hamilton-Buchanan)
- Genus:** *Puntius* Hamilton-Buchanan
 10. *Puntius conchonius* (Hamilton-Buchanan)
 11. *Puntius sarana* (Hamilton-Buchanan)
 12. *Puntius sophore* (Hamilton-Buchanan)
 13. *Puntius ticto* (Hamilton-Buchanan)
- Genus:** *Osteobrama* Heckel
 14. *Osteobrama cotio cotio* (Hamilton-Buchanan)
- Genus:** *Catla* Valenciennes
 15. *Catla catla* (Hamilton-Buchanan)
- Genus:** *Cirrhinus* Oken
 16. *Cirrhinus mrigala* (Hamilton-Buchanan)
 17. *Cirrhinus reba* (Hamilton-Buchanan)
- Genus:** *Labeo* Cuvier
 18. *Labeo bata* (Hamilton-Buchanan)
 19. *Labeo calbasu* (Hamilton-Buchanan)
 20. *Labeo gonius* (Hamilton-Buchanan)
 21. *Labeo rohita* (Hamilton-Buchanan)
- Subfamily:** Garrinae
Genus: *Garra* Hamilton-Buchanan
 22. *Garra gotyla gotyla* (Gray)
- Family:** Balitoridae
Subfamily: Nemacheilinae
Genus: *Acanthocobitis* Peters
 23. *Acanthocobitis botia* (Hamilton-Buchanan)
- Order:** Siluriformes
Family: Bagridae
Subfamily: Bagrinae
Genus: *Mystus* Scopoli
 24. *Mystus bleekeri* (Day)
 25. *Mystus tengara* (Hamilton-Buchanan)
- Genus:** *Sperata* Holly
 26. *Sperata aor* (Hamilton-Buchanan)
 27. *Sperata seenghala* (Sykes)
- Family:** Siluridae
Genus: *Ompok* Lacépède
 28. *Ompok bimaculatus* (Bloch)
- Genus:** *Wallago* Bleeker
 29. *Wallago attu* (Bloch & Schneider)
- Family:** Schilbeidae
Subfamily: Schilbeinae
Genus: *Eutropiichthys* Bleeker
 30. *Eutropiichthys vacha* (Hamilton-Buchanan)
- Genus:** *Silonia* Swainson
 31. *Silonia silondia* (Hamilton-Buchanan)
- Family:** Sisoridae
Genus: *Bagarius* Bleeker
 32. *Bagarius bagarius* (Hamilton-Buchanan)
- Family:** Clariidae
Genus: *Clarias* Scopoli
 33. *Clarias batrachus* (Linnaeus)
- Family:** Heteropneustidae
Genus: *Heteropneustes* Muller
 34. *Heteropneustes fossilis* (Bloch)
- Order:** Beloniformes
Family: Belonidae
Genus: *Xenentodon* Regan
 35. *Xenentodon cancila* (Hamilton-Buchanan)
- Order:** Synbranchiformes
Family: Mastacembelidae
Subfamily: Mastacembelinae
Genus: *Mastacembelus* Scopoli
 36. *Mastacembelus armatus* (Lacépède)
- Order:** Perciformes
Family: Chandidae (Ambassidae)
Genus: *Chanda* Hamilton-Buchanan
 37. *Chanda nama* (Hamilton-Buchanan)
- Family:** Nandidae
Subfamily: Nandinae
Genus: *Nandus* Valenciennes
 38. *Nandus nandus* (Hamilton-Buchanan)
- Family:** Gobiidae
Subfamily: Gobiinae
Genus: *Glossogobius* Gill
 39. *Glossogobius giurus* (Hamilton-Buchanan)
- Family:** Channidae
Genus: *Channa* Scopoli
 40. *Channa marulius* (Hamilton-Buchanan)
 41. *Channa striata* (Bloch)
 42. *Channa punctatus* (Bloch)

● No exotic fish was caught from Ramsagar reservoir.

